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AUTHOR Brooks, Larry W.: And Others
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ABSTRACT

The present study evaluated the effectiveness of embedded headings, with and without instructions on their usage, as processing aids for text material. It was expected that the Instructions/Headings group would outperform both the Headings Only and Control (no instructions or headings) groups, and that the performance of the Headings Only group would be superior to the Control group's. A 2,500-word prose passage extracted from an introductory college textbook on ecology was used as the to-be-learned material in this experiment. The Delta Vocabulary Test and the Group Embedded Figures Tests were used as measures of individual differences. Four dependent measures used to assess performance on the ecology passage were an essay exam, outline exam, short-answer exam, and multiple choice exam. Data were analyzed via six analyses of covariance. Results revealed that the Instructions/Headings group performed significantly better than the Headings Only and Control Groups on selected measures. No significant differences, however, were found between the Headings Only and Control conditions. In addition, it was found that field independent students outperformed field dependent students on a number of recall measures. Results are discussed in relationship to previous studies in this area. (Author/RL)

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Instructing Students on the Use of Headings as Aids in Processing Scientific Text

Larry W. Brooks

Donald F. Dansereau

Joni E. Spurlin

Texas Christian University

Charles D. Holley

Data Design Laboratories

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Abstract

The present study evaluated the effectiveness of embedded headings, with and without instructions on their usage, as processing aids for text material. It was expected that the Instructions/Headings group would outperform both the Headings Only and Control (no instructions or headings) groups, and that the performance of the Headings Only group would be superior to the Control group's. Results revealed that the Instructions/Headings group performed significantly better than the Headings Only and Control groups on selected measures. No significant differences, however, were found between the Headings Only and Control conditions. In addition, it was found that field independent students outperformed field dependent students on a number of recall measures. Results are discussed in relationship to previous studies in this area.

Instruction on the Use of Embedded Headings as Aids for Prose Processing

A number of recent studies have demonstrated that embedded headings are effective facilitators of prose processing (e.g., Dansereau, Brooks, Spurlin, & Holley, Note 1; Holley, Dansereau, Evans, Collins, Brooks, & Larson, in press). However, it has yet to be determined whether instruction on the use of headings as processing aids can improve the learning of scientific text. This paper reports on the effectiveness of one procedure developed to enhance students' use of headings.

Doctorow, Wittrock, and Marks (1978) demonstrated that headings, when used by themselves or in conjunction with instructions to write a one-sentence elaboration of the heading, improve learning of prose material compared to a control group. Although their study assessed the effects of elaboration instructions, there was no attempt to determine the effectiveness of instructions to use the headings in processing the remainder of the text. The same general comment is also relevant to a recent study by Dee-Lucas and DiVesta (1980) which indicated that having students generate their own headings facilitated text processing performance. However, to the best of our knowledge a study by Holley et al. (in press) is the only one that has investigated the effects of instructing students directly on the use of author-provided outlines and embedded headings as processing aids. Two separate groups of students

received instructions that were differentially oriented towards using the adjunct material for input (i.e., encoding) and output (i.e., retrieval) processing of the material. The remaining two groups in this study, headings and outlines or no headings and no outlines (Control), did not receive processing instructions. Results indicated that instructing students on the use of outlines and headings was ineffective in comparison with providing the students with outlines and headings without instruction. However, students that received outlines and headings (with or without instruction) significantly outperformed the control group on selected text processing tasks.

One possible reason for the lack of facilitative effects for instruction in the Holley et al. (in press) study is that the students were instructed either to use the outline and headings as input or output processing aids. This separation of processing may have allowed the "input" group to store the information effectively but did not give them adequate procedures for retrieving the stored information. The opposite scenario may have occurred with the "output" group. If this is the case, instructing participants on both input and output uses of headings should lead to improved performance.

Therefore, the current study is concerned with the effects of instructing students to use embedded headings to facilitate both the input and output stages of prose processing. Outlines were not included in the present study since they appear to be only margin-

ally effective as processing aids in similar paradigms (e.g., Dansereau, et al., Note 1).

Secondarily, the present study is also concerned with individual differences in prose processing. Brooks and Dansereau (Note 2), among others (e.g., Vaidya & Chansky, 1980; Pierce, 1980), have shown that students who score as field independent on the Group Embedded Figures Test (Oltman, Raskin, & Witkin, 1971) perform significantly better on a number of processing measures than students who score as field dependent. The present study attempts to replicate this finding and to determine whether there are significant interactions with the treatment conditions. For example, it may be the case that field independent readers can more effectively make use of headings than field dependent students since they may be better able to relate the superordinate headings to the relevant subordinate material appearing within the text. Given that headings may represent the unique schema for a passage, such a result would be in line with a study by Spiro and Tirre (1980) who found that field independent readers were more successful at using higher level prior knowledge (i.e., stored schemata) in processing new text material.

Method

Participants

One hundred and six students were recruited from general psychology classes at Texas Christian University. All participants were randomly assigned to the following three groups: Instructions-

plus-Headings (n=31), were given instructions on using headings to facilitate the input and output processing of text; Headings Only (n=44), studied text material containing headings but did not receive instructions; Control (n=31), studied text material that did not contain headings.

Stimulus Material

A 2,500-word prose passage extracted from an introductory college textbook on ecology was used as the to-be-learned material in this experiment. Past studies have shown this passage to be relatively unfamiliar to most students (e.g., Dansereau et al., Note 1; Holley et al., in press).

Measures

The Delta Vocabulary Test (Deignan, 1973) and the Group Embedded Figures Test (GEFT; Oltman, Raskin, & Witkin, 1971) were used as measures of individual differences. The Delta Vocabulary Test, which was used as a covariate to reduce within-cell variance, has been shown to be moderately related ($r \geq .60$) to more time-consuming measures of verbal aptitude such as the Scholastic Aptitude Test-Verbal. As previously stated, the GEFT, which purports to measure field independence-dependence, has recently been shown to be related to prose processing performance in a number of studies (e.g., Brooks & Dansereau, Note 2; Spiro & Tirre, 1980).

Four dependent measures were used to assess performance on the ecology passage. These tests consisted of: (a) an essay exam

(17 minutes) which required students to write an organized summary of the passage; (b) an outline exam (10 minutes) which required students to create an organized outline of the passage; (c) a short-answer exam (12 minutes) which consisted of 9 items covering topics in the passage, and (d) a multiple choice exam (10 minutes) which consisted of 28 items. Both the essay and outline exams were scored for their content and organization. The multiple choice test has been used previously (Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1979), and has been modified on the basis of item analyses.

Procedure

The participants were given the following sequence of experimental sessions:

1. Session 1 (105 minutes) -- Participants filled out consent forms and then completed the Delta Vocabulary Test and the Group Embedded Figures Test. The Instructions-plus-Headings group then received instructions on using embedded headings to facilitate input, storage, and output. These instructions consisted of a checklist of cognitive activities the student should engage in while studying text material. In part, students were asked to: (a) develop expectations (based on the headings) about the material in the passage, (b) understand why each heading was appropriate for its section of text, (c) memorize the headings, and (d) practice using the headings as recall aids. They then practiced these

techniques on a 1,200-word passage that described functions of the nervous system. The Headings Only and Control groups received instructions to use their typical study methods in practicing on the nervous system passage. (The Control group studied a version of the passage that did not contain headings.)

2. Session 2 (75 minutes) -- After the participants were reminded of the instructions they had received in the previous session, they studied the ecosystem passage for 55 minutes. The Instructions-plus-Headings and Headings-Only groups studied passages containing embedded headings while the Control group studied identical passages that did not contain headings.
3. Session 3 (60 minutes) -- During this session, the participants were sequentially administered the four dependent measures (essay, outline, short-answer, and multiple choice) over the passage studied 5 days earlier. This pattern of test administration (recall-then-recognition) has been suggested by Battig (1979).

Results

Each of the dependent measures was scored according to predetermined keys and without knowledge of group affiliation. Interrater reliabilities for both content and organization scores on the essay exam were assessed by having a colleague score a random subset of the exams. Interrater reliability coefficients of .95

and .93 were obtained for the content and organization scores, respectively. These coefficients were considered to represent an acceptable degree of interrater reliability.

The data were analyzed via a series of six 3 x 2 analyses of covariance. The first factor represented groups (Instruction-plus-Headings, Headings Only, and Control), the second factor consisted of high and low (median split) GEFT subgroups, and verbal ability was the covariable. While this approach to investigating individual differences using a dichotomized continuous variable is controversial (e.g., Humphreys, 1978; Humphreys & Fleishman, 1974), it has proven useful in previous research (e.g., Das & Kirby, 1978), and is problematic mainly in that it is a more conservative test (i.e., less powerful) than correlational analysis (Cronbach & Snow, 1977).

A univariate approach was used in the present experiment in order to provide detailed information on the sensitivity of the various types of testing to the treatment effects. It is recognized that under these circumstances the results should be interpreted cautiously due to the inflated Type I errors and intercorrelations of the performance scores. In order to obtain equal Ns per cell a random subset of subjects was dropped from the data pool. The same set of subjects was used in all analyses.

Prior to further analysis, tests of the within-group regression slopes for each ANCOVA were computed. All tests were nonsignificant, $\underline{F}s(5,78) < .49$, $\underline{p} > .78$, indicating that the assumption of homogeneity of within-group regression slopes was not violated.

Significant main effects for groups were found for essay content, $F(2,83) = 3.90$, $p < .02$, outline content, $F(2,83) = 19.39$, $p < .01$, and outline organization, $F(2,83) = 17.00$, $p < .01$. The second factor representing GEFT subgroups was also significant for essay organization $F(1,83) = 3.83$, $p < .05$, outline content, $F(1,83) = 19.39$, $p < .04$, outline organization, $F(1,83) = 5.10$, $p < .03$, and short-answer, $F(1,83) = 6.86$, $p < .01$; this factor also approached significance for the essay content score, $F(1,83) = 3.31$, $p < .07$. In all cases, field independent students outperformed field dependent students. None of the interaction terms were significant for any of the measures. Means and standard deviations are presented in Table 1. Tukey post hoc comparisons were computed for the first factor on essay content, outline content, and outline organization. Results revealed that on essay content the Instructions-plus-Headings group significantly outperformed the Control group ($p < .05$); for the outline content and organization exams, the Instructions-plus-Headings group performed significantly better than the Headings-Only group ($ps < .01$), and the Control group ($ps < .01$). No other comparisons on any of the three measures were significant.

Insert Table 1 about here

Discussion

This study suggests that instructing students on how to use text headings as study aids is an effective technique for improving performance on selected recall measures. Specifically, it was found that students in the instructional condition outperformed students in the Headings-Only group on the outline content and organizational measures. The instructional group also performed

better than the Control (no headings) group on both of the outline measures and the essay content exam.

The pattern of results obtained in this study suggests that headings may have their greatest effects as retrieval aids. Specifically, this contention is supported by the fact that the Instructions-plus-Headings group significantly outperformed the Control group on the uncued tests (essay and outline) but not on the cued exams (short-answer and multiple choice). Further support is also derived from the Holley et al. (in press) and Dansereau et al. (Note 1) studies in which delayed testing proved to be more sensitive to the headings effects than immediate testing. Presumably retrieval becomes a more critical process as the time between studying and testing increases.

The fact that the Headings-Only group (without instructions) did not significantly outperform the Control group on any of the measures is somewhat puzzling in light of the findings of the Dansereau et al. (Note 1) study which showed a relatively strong positive effect for embedded headings without explicit instructions. Although both studies used similar procedures and measures, two procedural changes in the present study may account for the discrepancy between the two sets of results. In the Dansereau et al. (Note 1) study students may have been sensitized to the presence of headings. This sensitization could be due to the participants' receiving both immediate and delayed passages and tests, and/or to questionnaires given to the participants concerning

their typical use of outlines and headings. In the present study participants were not exposed to either of these manipulations, and so may not have directed as much attention to the headings as in the previous experiment. The possibility of such sensitizing effects when complex prose material of this type is employed has been suggested by other researchers (e.g., Dee-Lucas & DiVesta, 1980). If this contention is valid, it may be that a primary effect of instructions is to sensitize the student to the presence of headings in text material. Future studies are now being planned which will take this factor into account.

A secondary purpose of the present study was to determine if field independence interacted with the treatment conditions. Although no significant interactions were observed, the results did replicate earlier studies on text processing (e.g., Brooks & Dansereau, Note 2; Collins, 1979) that have found an "across the board" effect for field dependence with the average score for field independent individuals being higher than for field dependent persons. It may be that students who score as field independent are better able to abstract the important information contained in a text from its accompanying general, "background" material using a process analogous to the one used in identifying a simple geometric figure within a more complex design. If such is the case, then it would seem probable that both processes involve the same underlying cognitive mechanisms.

In summary, results of the present study indicate that instructing students on how to use embedded headings as input and output processing aids is an effective technique for enhancing recall of text material. Additionally, the findings of earlier studies that field independent individuals, regardless of treatment condition, tend to score higher than field dependent individuals on text recall tests were replicated.

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Table 1

Unadjusted and Adjusted Means and Standard Deviations for Each of the Dependent Measures*

Group		ESSAY				OUTLINE			
		Content		Organization		Content		Organization	
		Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Instructions/ Headings									
High GEFT	$\bar{x}$	16.47	15.57	5.87	5.72	28.53	27.33	6.93	6.64
(n=15)	sd	5.07	3.29	1.26	1.32	12.19	11.33	3.68	3.55
Low GEFT	$\bar{x}$	14.27	14.99	4.33	4.45	21.33	22.30	4.27	4.50
(n=15)	sd	7.32	5.49	2.21	1.88	9.88	9.13	2.74	2.38
Headings Only									
High GEFT	$\bar{x}$	15.93	14.87	5.47	5.30	19.07	17.65	3.87	3.52
(n=15)	sd	5.05	4.88	2.42	2.25	7.60	6.49	1.36	1.19
Low GEFT	$\bar{x}$	11.60	12.32	4.73	4.85	12.47	13.44	2.67	2.90
(n=15)	sd	4.56	4.30	1.69	1.89	5.39	5.58	1.25	1.26
Control									
High GEFT	$\bar{x}$	12.53	13.00	5.07	5.14	12.53	13.15	2.60	2.75
(n=15)	sd	4.80	3.97	1.53	1.46	5.86	5.20	1.14	0.96
Low GEFT	$\bar{x}$	10.80	10.84	4.60	4.61	12.87	12.92	2.73	2.75
(n=15)	sd	4.97	4.72	1.62	1.75	6.52	4.64	1.06	0.68

*Scores adjusted using the Delta Vocabulary as a covariate.

Table 1 Continued

Unadjusted and Adjusted Means and Standard Deviations

for Each of the Dependent Measures*

Group		Dependent Measures: SHORT ANSWER Unadjusted	SHORT ANSWER Adjusted	MULTIPLE CHOICE Unadjusted	MULTIPLE CHOICE Adjusted
Instructions/ Headings					
High GEFT (n=15)	$\bar{x}$	18.87	17.59	20.47	19.54
	sd	7.54	6.32	4.46	3.80
Low GEFT (n=15)	$\bar{x}$	13.67	14.69	18.47	19.21
	sd	7.65	4.93	5.54	4.00
Headings Only					
High GEFT (n=15)	$\bar{x}$	19.00	17.50	21.40	20.31
	sd	8.29	7.08	3.63	2.8[illegible]
Low GEFT (n=15)	$\bar{x}$	12.80	13.83	16.87	17.61
	sd	6.06	5.05	5.81	4.71
Control					
High GEFT (n=15)	$\bar{x}$	14.13	14.79	17.87	18.35
	sd	6.77	5.47	5.38	3.78
Low GEFT (n=15)	$\bar{x}$	11.80	11.86	18.67	18.71
	sd	5.15	4.82	3.63	2.86

*Scores adjusted using the Delta Vocabulary as a covariate.